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ST VL53L4ED Expansion Board Nucleo Based User Manual

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Contents

Introduction

The X-NUCLEO-53L4A3 is an expansion board for any STM32 Nucleo development board equipped with the Arduino R3 connectors. It provides a complete evaluation kit that allows you to learn, evaluate, and develop applications using the VL53L4ED Time-of-Flight high-accuracy proximity sensor with extended temperature capability.

The expansion board is delivered with a cover glass holder in which you can fit three different spacers of 0.25, 0.5,

and 1 mm height below the cover glass to simulate various air gaps. A small oval cover glass fitting the sensor is included.

Several ST expansion boards can be stacked through the Arduino connectors, which allow, for example, the development of VL53L4ED applications with Bluetooth or Wi-Fi interfaces.

Figure 1. X-NUCLEO-53L4A3 expansion board, spacers, cover glass holder, and oval cover glass

Getting started

Safety considerations

Electrostatic precautions

Warning: Take electrostatic precautions, including ground straps, when using the **X-NUCLEO-53L4A3** expansion board. Failure to prevent electrostatic discharge could damage the device.

Figure 2. Electrostatic logo

Laser safety considerations

The **VL53L4ED** contains a laser emitter and the corresponding drive circuitry. The laser output is designed to remain within Class 1 laser safety limits under all reasonable foreseeable conditions, including single faults, in compliance with the IEC 60825-1:2014 (third edition). The laser output remains within Class 1 limits as long as you use the STMicroelectronics recommended device settings and respect the operating conditions specified in the data sheet. The laser output power must not be increased and no optics should be used with the intention of focusing the laser beam.

Figure 3. Class 1 laser product label

Features

- **VL53L4ED** Time-of-Flight high-accuracy proximity sensor with extended temperature capability
- Accurate absolute ranging distance, independent of the reflectance of the target
- 0.25, 0.5, and 1 mm spacers to simulate air gaps
- Two different cover glasses to protect the sensor from dust
- Compatible with **STM32 Nucleo** development boards
- Equipped with Arduino UNO R3 connectors
- Full system software supplied, including code examples and graphical user interface
- RoHS, CE, UKCA, and China RoHS compliant

Spacers and covers

The **X-NUCLEO-53L4A3** expansion board is delivered with:

- three spacers of 0.25 mm, 0.5 mm, and 1 mm height, used to simulate different air gaps between the **VL53L4ED** and the rectangular-shaped cover glass;
- an oval-shaped cover glass to simulate the integration of the **VL53L4ED** into the customer's final product;
- two six-pin headers that allow connecting the two breakout boards to the **X-NUCLEO-53L4A3** expansion board.

Attention: The VL53L4ED is delivered with a liner to prevent potential foreign material from piercing the module holes during the assembly process. Remove this liner before use.

Ordering information

To order the Time-of-Flight high-accuracy proximity sensor with extended temperature capability expansion board based on the **VL53L4ED**, refer to the table below.

Attention: The VL53L4ED is delivered with a liner to prevent potential foreign material from piercing the module holes during the assembly process. Remove this liner before use.

Table 1. Ordering information

Order code	FG version	Core product
X-NUCLEO-53L4A3	X$NUCLEO-53L4A3A	**VL53L4ED**

Simplified schematic

Figure 4. X-NUCLEO-53L4A3 expansion board – simplified schematic
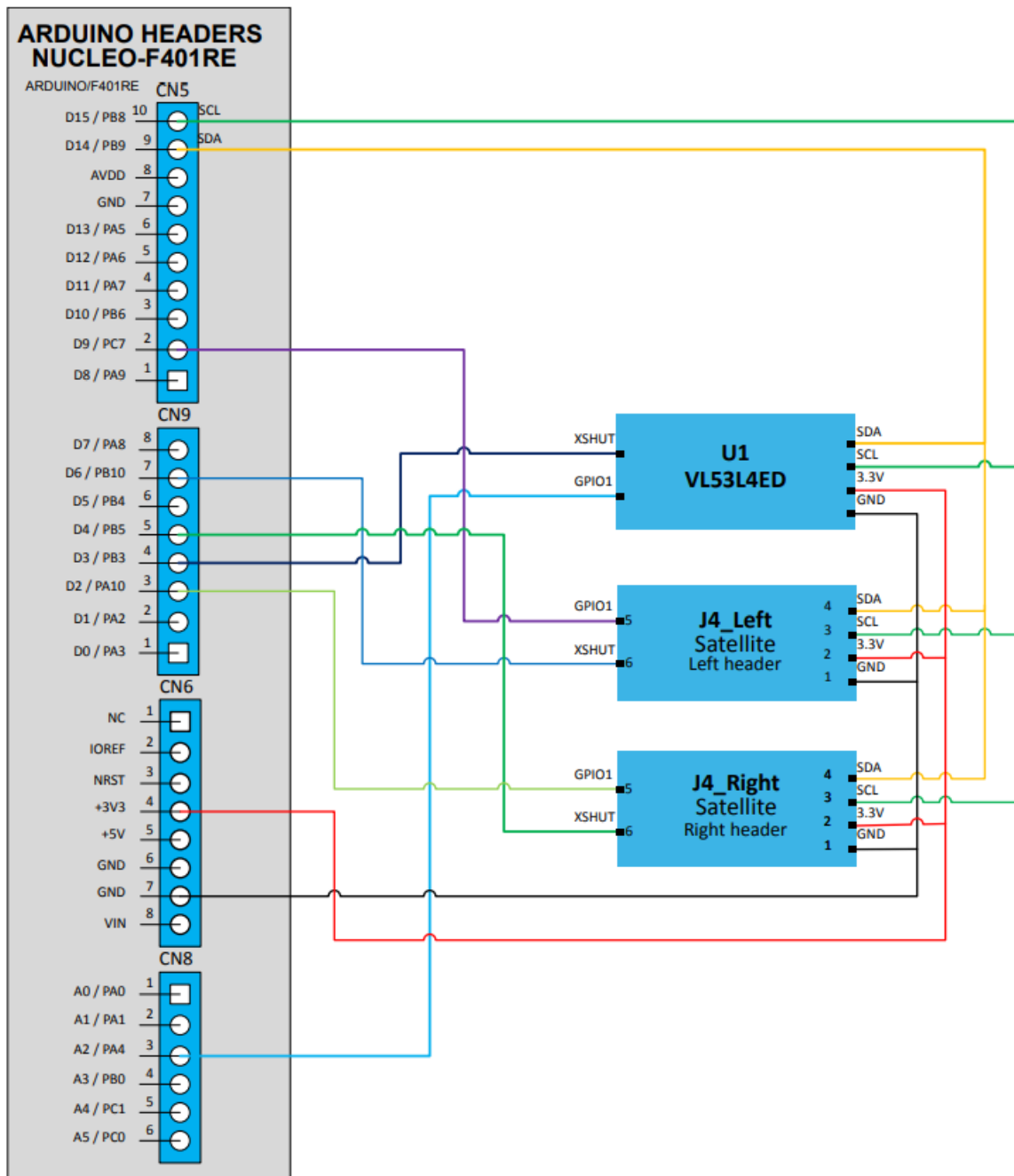
Using the expansion board

The **X-NUCLEO-53L4A3** expansion board allows the user to test the **VL53L4ED** sensor functionality, to program it and to understand how to develop an application using this sensor.

The **X-NUCLEO-53L4A3** integrates:

- the **VL53L4ED** sensor;
- Arduino UNO R3 connectors;
- Connectors for **SATEL-VL53L4ED** optional breakout boards;

Important: Program a microcontroller to control the **VL53L4ED** through the I2C bus.
The application software and an example of the C-ANSI source code are available on the **sensor web page**.
The **X-NUCLEO-53L4A3** expansion board can be connected to the **STM32 Nucleo** development board through the Arduino UNO R3 connectors (CN5, CN6, CN8, and CN9) as shown in Figure 4.

Breakout boards

The **X-NUCLEO-53L4A3** package does not include the **VL53L4ED** breakout boards.
You can purchase them in a pack of two PCBs as SATEL-VL53L4ED.

The **X-NUCLEO-53L4A3** supplies the **VL53L4ED** breakout boards at 3.3 V (see Figure 4).

For mechanical integration purposes, it could be interesting to use the mini PCB by breaking the **SATELVL53L4ED** along the red line as shown in the figure below. It is easier to integrate this setup into a customer's device thanks to its small size.

Figure 5. SATEL-VL53L4ED
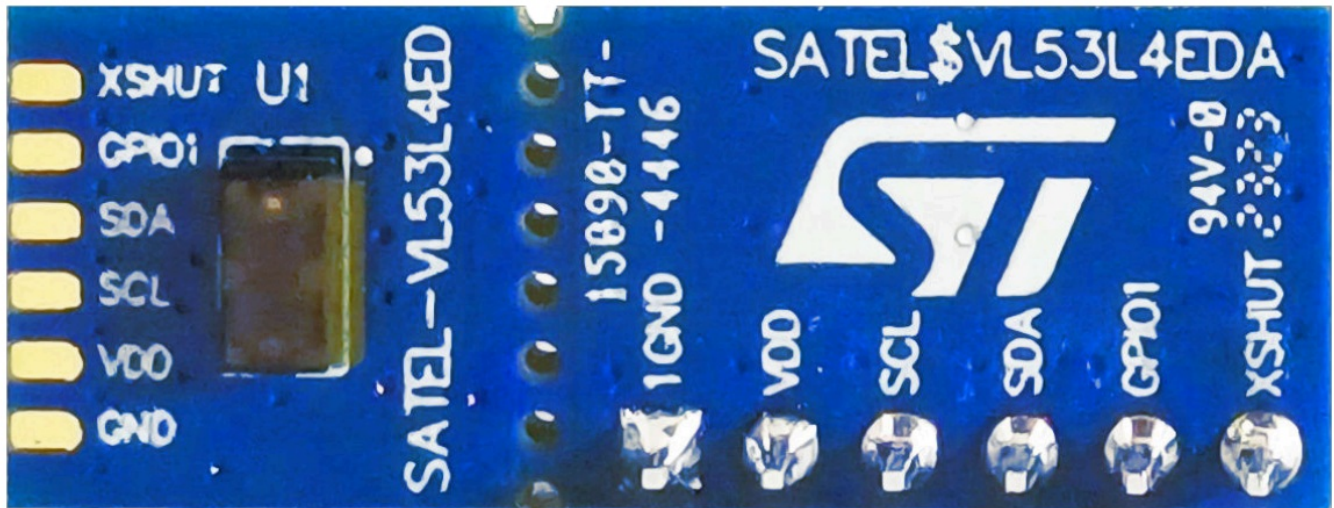
The **SATEL-VL53L4ED** boards can be directly plugged onto the **X-NUCLEO-53L4A3** through the two 6-pin headers (see Figure 6).

As an alternative, they can be connected to the **X-NUCLEO-53L4A3** by using the mini PCB through flying wires (see Figure 7).

Figure 6. SATEL-VL53L4ED breakout boards connected to the X-NUCLEO-53L4A3 expansion board

Figure 7. VL53L4ED mini PCB flying wire connection to the X-NUCLEO-53L4A3 expansion board
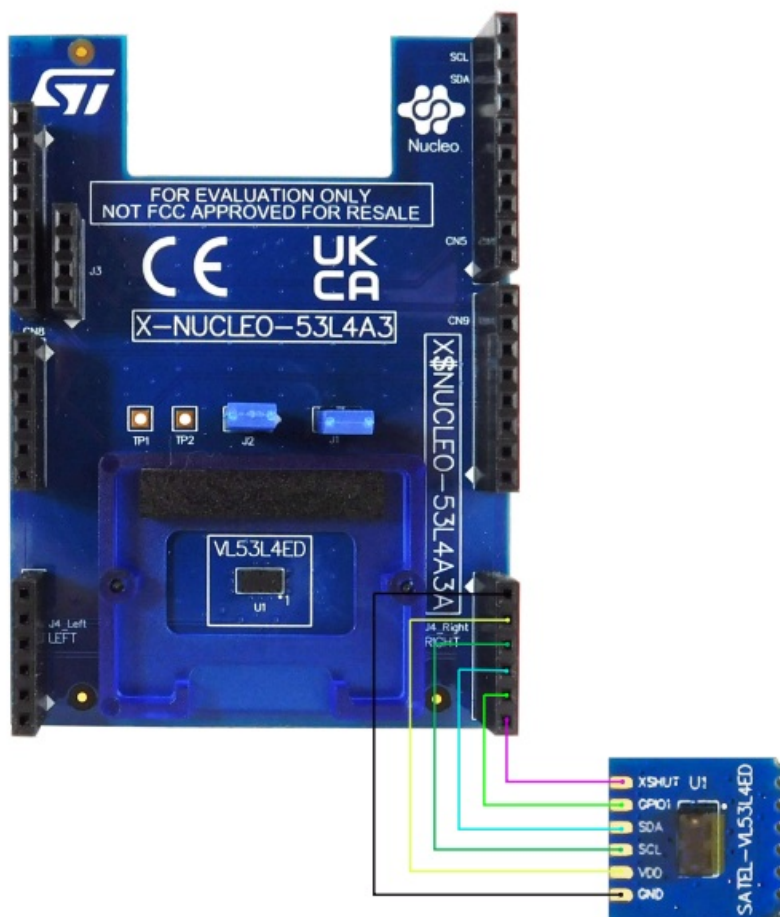
Graphical user interface

(GUI) and programming example for the XNUCLEO-53L4A3

To evaluate the **VL53L4ED** device performance, use the related GUI or the **X-CUBE-TOF1**.
The **X-NUCLEO-53L4A3** expansion board requires the **NUCLEO-F401RE** development board to use the GUI or run the ranging examples included in the X-CUBE-TOF1.

Important: Despite the fact that the **X-NUCLEO-53L4A3** can be stacked on any **STM32 Nucleo** board equipped the Arduino R3 connectors, the GUI is designed to work with the **NUCLEO-F401RE** only. Download the GUI (in the Tools and Software tab of the **X-NUCLEO-53L4A3** web page) or the **X-CUBE-TOF1** to evaluate the **VL53L4ED**.

Schematic diagrams

Note: These schematic diagrams refer to the board latest version.

Figure 8. X-NUCLEO-53L4A3 circuit schematic (1 of 6)
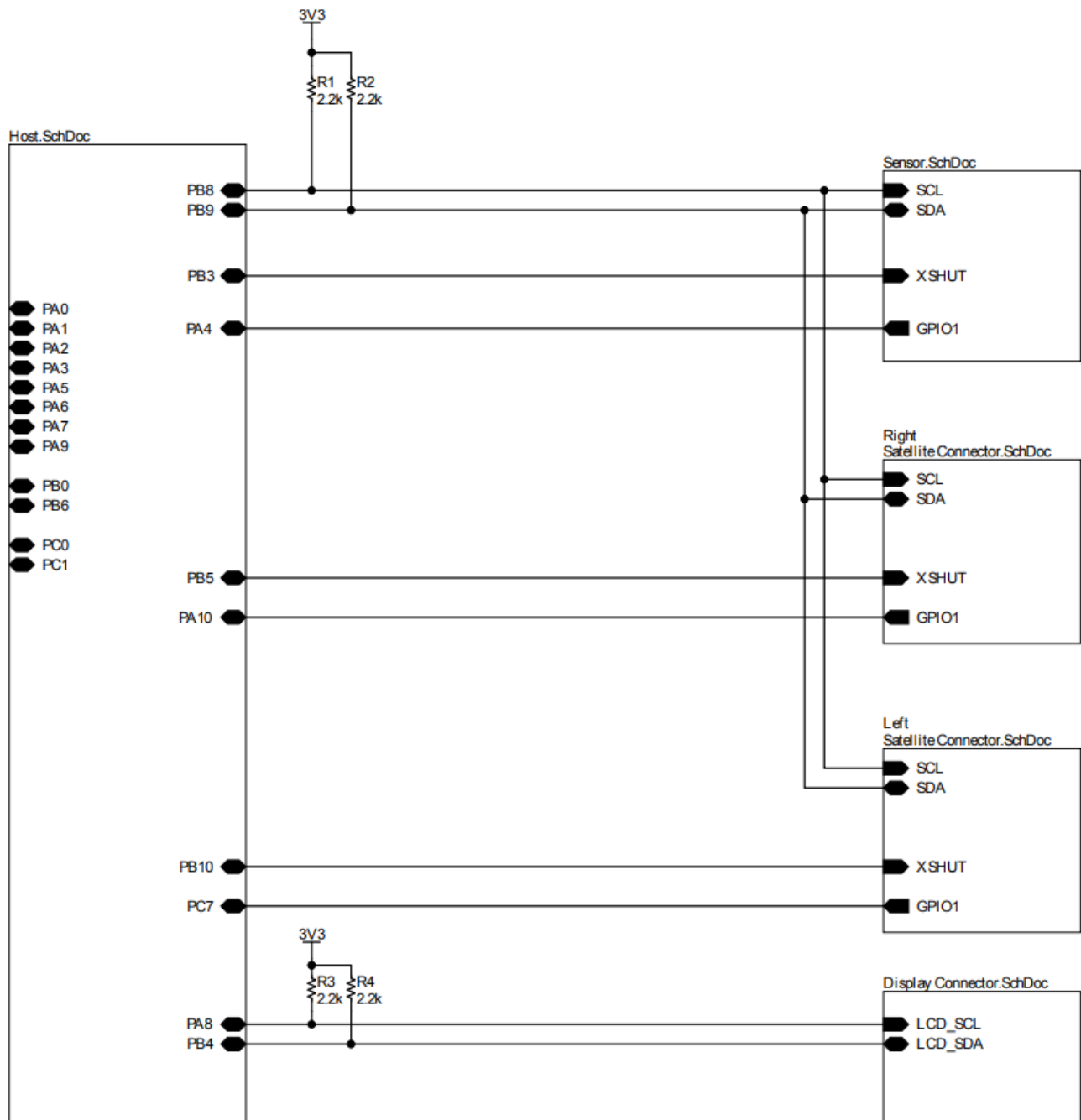
Note: The display connector is an optional connector to connect an SSD1306 I2C OLED display to output the ranging data or other meaningful information if required. The related application note and example code will be available on **st.com**.
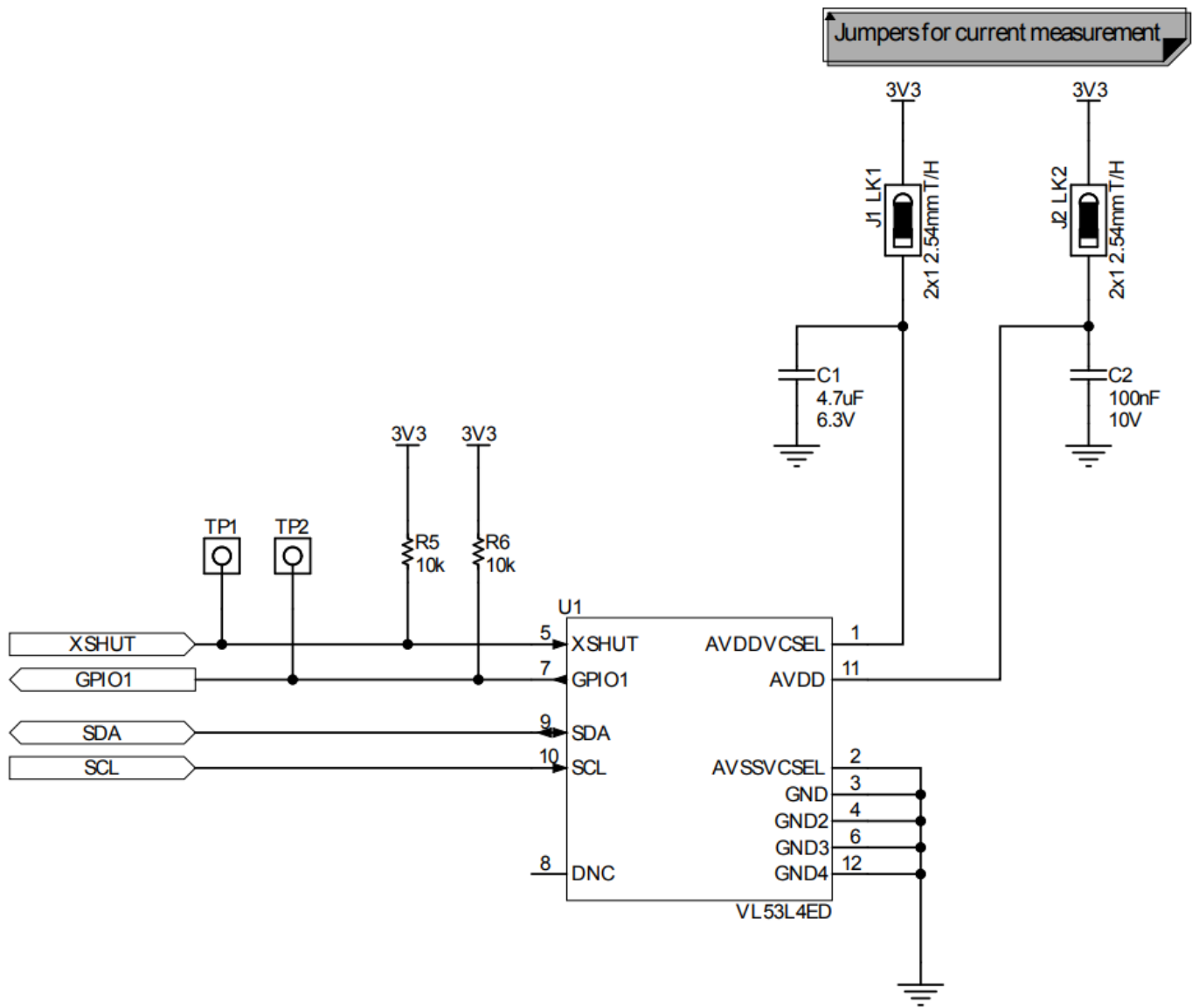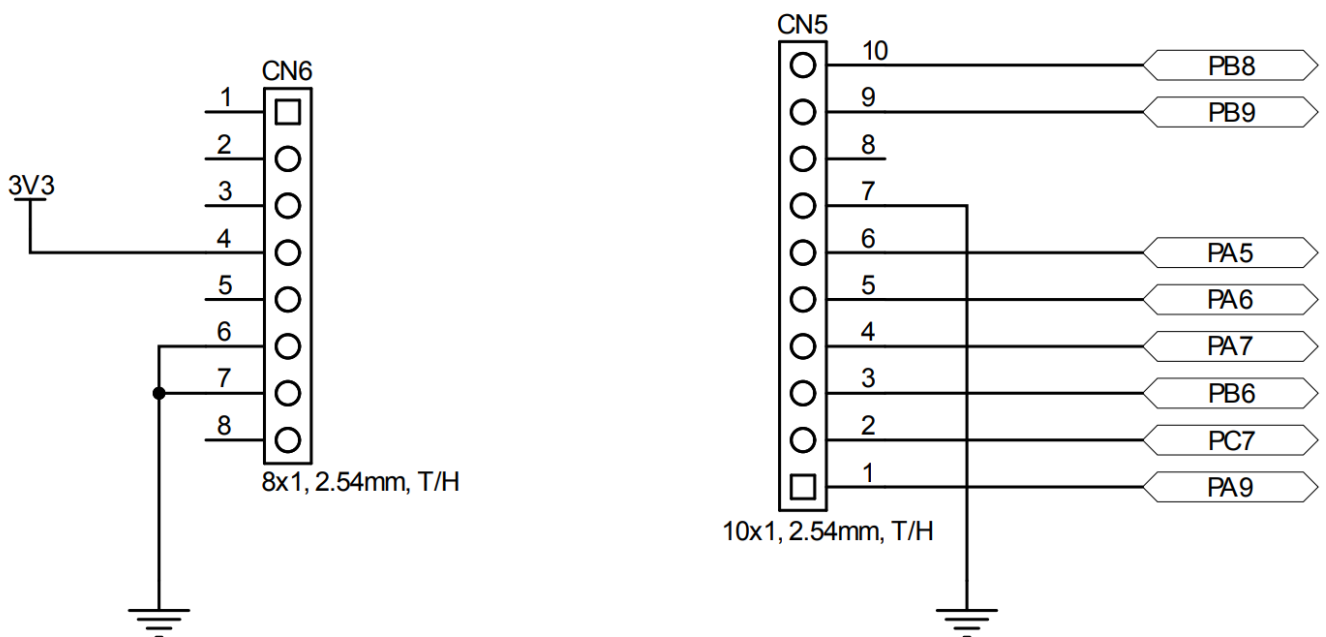
Figure 9. X-NUCLEO-53L4A3 circuit schematic (2 of 6)

3V3   3V3

J1 LK1   2x1 2.54mm T/H   J2 LK2   2x1 2.54mm T/H

C1   C2
4.7uF   100nF
6.3V   10V

TP1   TP2   3V3   3V3

R5   R6
10k   10k

	U1		
XSHUT	5	XSHUT	AVDDVCSEL	1
GPIO1	7	GPIO1	AVDD	11
SDA	9	SDA		
SCL	10	SCL	AVSSVCSEL	2
			GND	3
			GND2	4
			GND3	6
	8	DNC	GND4	12

VL53L4ED

Figure 10. X-NUCLEO-53L4A3 circuit schematic (3 of 6) Nucleo Arduino Connectors

CN6

1		
2		
3V3
3		
4		
5		
6		
7		
8		

8x1, 2.54mm, T/H

CN5

10	PB8
9	PB9
8	
7	
6	PA5
5	PA6
4	PA7
3	PB6
2	PC7
1	PA9

10x1, 2.54mm, T/H
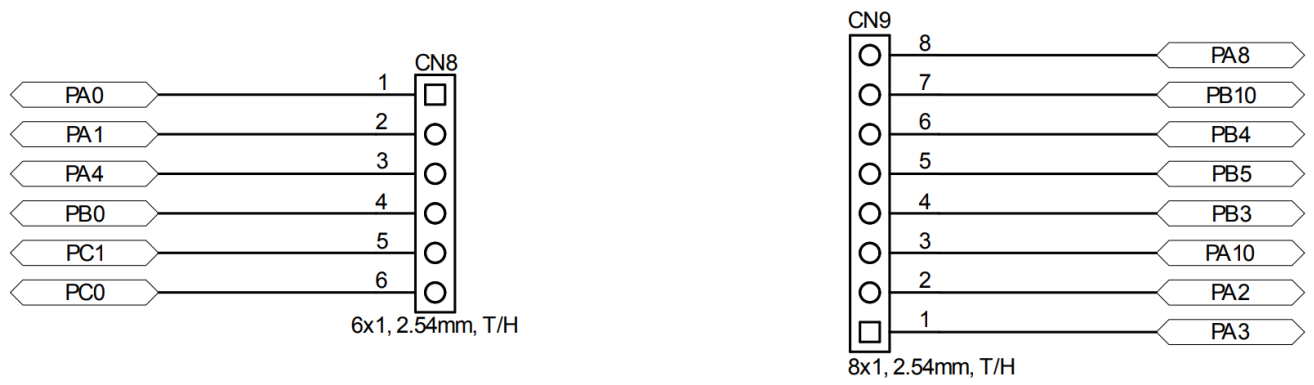
Figure 11. X-NUCLEO-53L4A3 circuit schematic (4 of 6)
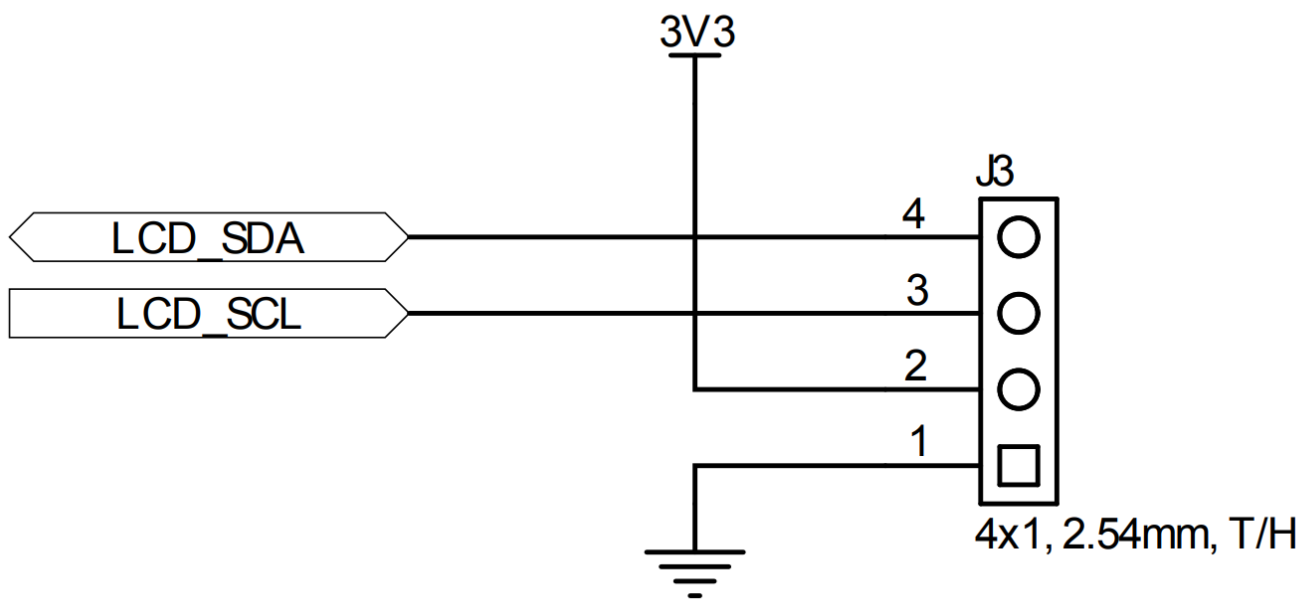
Figure 12. X-NUCLEO-53L4A3 circuit schematic (5 of 6)

Header for Satellite Board
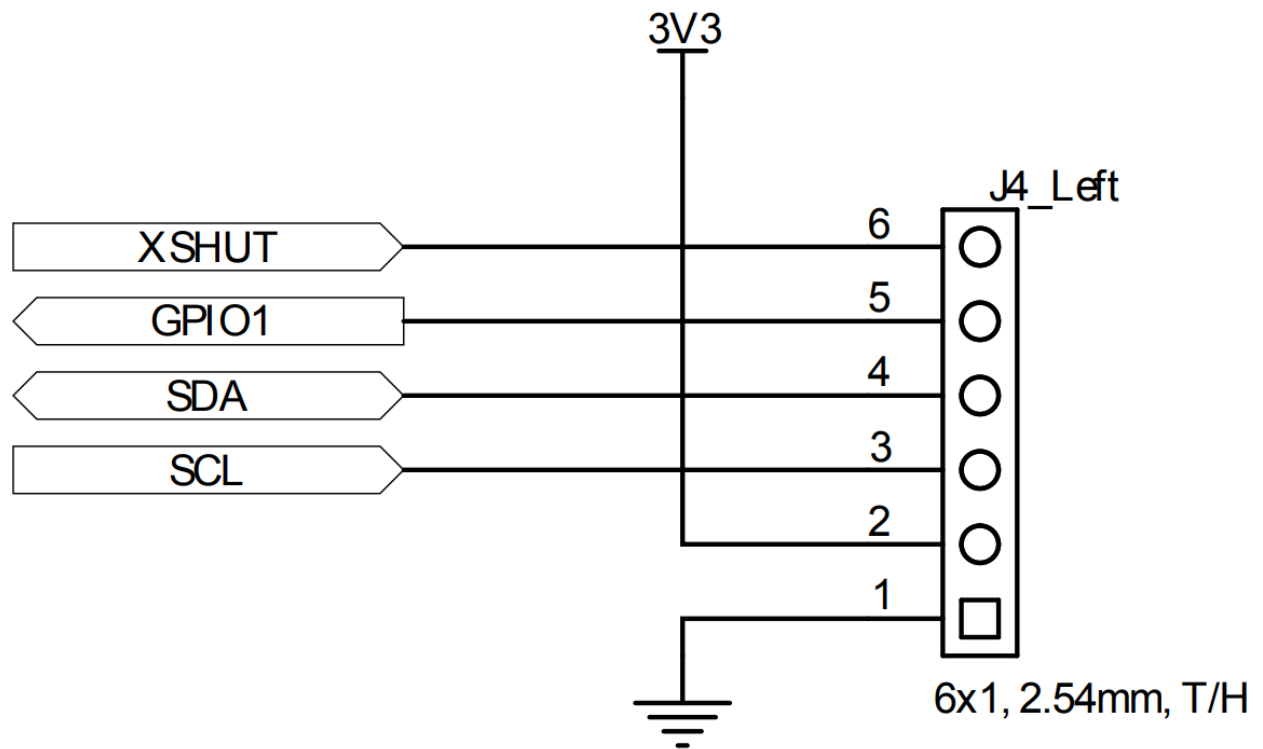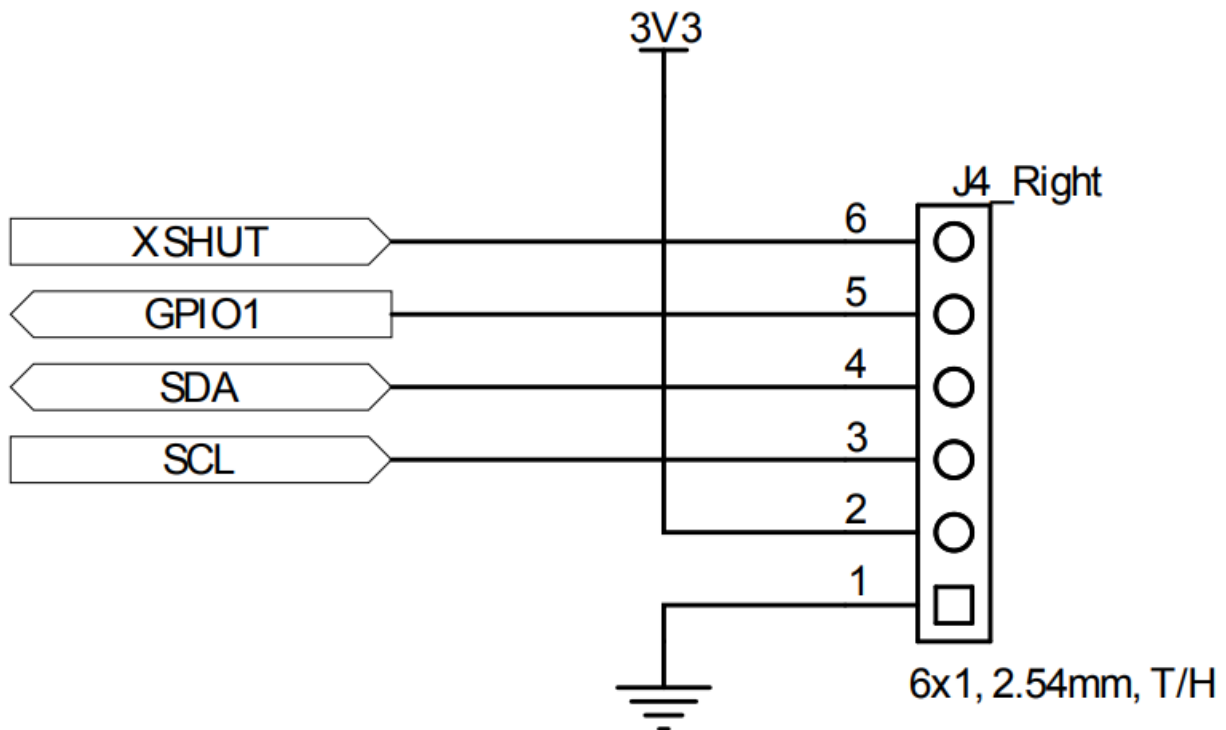
Figure 13. X-NUCLEO-53L4A3 circuit schematic (6 of 6)

Header for Satellite Board

Bill of materials

Note: This BOM refers to the board latest version.

Table 2. X-NUCLEO-53L4A3 bill of materials

Item	Quantity	Reference	Part/value	Description	Manufacturer	Order code
1	0	J3	4-position, SNGL, 4×1, 2.54 mm, T/H	Connector header (not mounted)	Samtec	SSW-104-01-G-S
2	1	C1	4.7 µF, 6.3 V, X5R, 0402	Ceramic capacitor	TDK	C1005X5R0J475K050BC
3	1	C2	100 nF, 10 V, X5R, 0201	Ceramic capacitor	Murata	GRM033R61A104KE15D
4	1	CN5	10-position, SNGL, 2.54 mm, T/H	Connector header	Samtec	SSQ-110-03-F-S
5	1	CN8	6-position,POS, SNGL, 2,54 mm, T/H	Connector header	Samtec	SSQ-106-03-F-S
6	1	U1	VL53L4ED	Time-of-Flight long ranging sensor with short distance capability	ST	**VL53L4ED**
7	2	J1, J2	2-position, 2.54 mm, T/H, vertical	Connector headers	Harwin	M20-9990245
8	2	J4_Left, J4_Right	6-position, SNGL, 6×1, 2.54 mm, T/H	Connector headers	Samtec	SSW-106-01-G-S
9	2	CN6, CN9	8-position, SNGL, 2.54 mm, T/H	Connector headers	Samtec	SSQ-108-03-F-S
10	2	R5, R6	10 k, ±1%, 1/16 W, 0402	Resistors	Stackpole Electronics	RMCF0402FT10K0
11	2	LK1, LK2	2.54 mm	Headers	Harwin	M7571-05
12	4	R1, R2, R3, R4	2.2 k, ±1%, 1/16 W, 0402	Resistors	Stackpole Electronics	RMCF0402FT2K20
13	1	Glass piece	PMMA	Glass piece	Hornix	Custom
14	1	Spacer	Black, PVC, rigid, 0.25 mm	Thick spacer	STEP File	Custom
15	1	Spacer	Black, PVC, rigid, 0.5 mm	Thick spacer	STEP File	Custom
16	1	Spacer	Black, PVC, rigid, 1.0 mm	Thick spacer	STEP File	Custom
17	1	Foam piece	Polyurethane, foam flexible, 25 mm x 3 mm x 2.4 mm	Foam piece	STEP File	Custom

18	2	Tapping screw	Black steel, M 1.7 x 8.0 mm	Black cross, round-head, self- tapping screw	–	–
19	1	Glass holder	Epoxy 1mm	Cover glass holder	STEP File	Custom
20	1	Cover glass	PMMA	Oval cover glass	Hornix	Custom

Board versions

Table 3. X-NUCLEO-53L4A3 versions

FG version	Schematic diagrams	Bill of materials
X$NUCLEO-53L4A3A(1)	**X$NUCLEO-53L4A3A schematic diagrams**	**X$NUCLEO-53L4A3A bill of materials**

1. This code identifies the X-NUCLEO-53L4A3 expansion board first version. It is printed on the board PCB.

Regulatory compliance information

Notice for US Federal Communication Commission (FCC)

For evaluation only; not FCC approved for resale

FCC NOTICE – This kit is designed to allow:

1. Product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and
2. Software developers to write software applications for use with the end product.

This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter 3.1.2.

Notice for Innovation, Science and Economic Development Canada (ISED)

For evaluation purposes only. This kit generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to Industry Canada (IC) rules.

Notice for European Union

This device is in conformity with the essential requirements of the Directive 2014/30/EU (EMC) and of the Directive 2015/863/EU (RoHS).

Notice for United Kingdom

This device is in compliance with the UK Electromagnetic Compatibility Regulations 2016 (UK S.I. 2016 No. 1091) and with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (UK S.I. 2012 No. 3032).

Appendix A References

- **VL53L4ED** data sheet: DS14256
- **X-NUCLEO-53L4A3** data brief: DB5074
- **X-CUBE-TOF1** data brief: DB4449

Revision history

Table 4. Document revision history

Date	Revision	Changes
19-Dec-2023	1	Initial release.

IMPORTANT NOTICE – READ CAREFULLY

Documents / Resources

ST VL53L4ED Expansion Board Nucleo Based [pdf] User Manual
VL53L4ED Expansion Board Nucleo Based, VL53L4ED, Expansion Board Nucleo Based, Board Nucleo Based, Nucleo Based

References

- **User Manual**